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ABSTRACT

This workbook is part three of a self-instructional course prepared for the United States Environmental Protection Agency. The student proceeds at his own pace and when questions are asked, after answering, he either turns to the next page to check his response or refers to the previously covered material. The purpose of this course is to prepare the student for his APC Training Certificate. This workbook is concerned with troubleshooting to find out if the oil temperature on the boiler is correct. (BT)

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Air Pollution Training Institute Self-Instructional Course SI-466

Part 3
Troubleshooting, Section One
Boilers: Correcting Oil Temperature

SE CIS 638

United States
Environmental Protection Agency
Office of Air and Water Programs

Training Manual
Self-Instructional Course SI-466

Air Pollution Training Institute

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Part Three:
Troubleshooting
Section One
Boilers: Correcting Oil Temperature

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Prepared for the
United States Environmental Protection Agency
Office of Air and Water Programs
Control Programs Development Division
Air Pollution Training Institute

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THIS IS PART
TROUBLESHOOTING, SECTION ONE
BOILERS: CORRECTING OIL TEMPERATURE

Additional units of this self-instructional course are:

PART ONE
The Basics of Preventing Air
Pollution Emissions from Boilers

PART TWO
The Basics of Boiler Operation
and Maintenance

PART FOUR
Troubleshooting, Section Two
Boilers: Flame Reading

PART FIVE
The Incinerator: Section One
Basic Parts and Fundamentals

PART SIX
The Incinerator: Section Two
Maintenance and Troubleshooting

SUPPLEMENT A:
Operator's Manual, Boiler Room
Operations and Maintenance

TROUBLESHOOTING SMOKE

So far you have seen what a boiler system is all about and how to keep it operating smoothly.

Now for troubleshooting. What to do if you get smoke.

This first section is concerned with troubleshooting to find out if the oil temperature is incorrect.

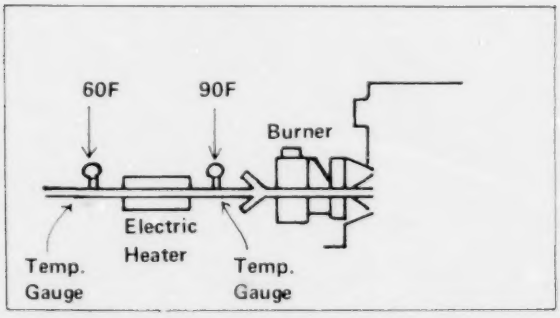
1. TROUBLESHOOTING SMOKE: WHAT TO DO WHEN THE SMOKE ALARM GOES OFF

INCORRECT OIL TEMPERATURE IS THE BIGGEST CAUSE OF SMOKE. Check this first. Correct temperature depends on the oil being used.

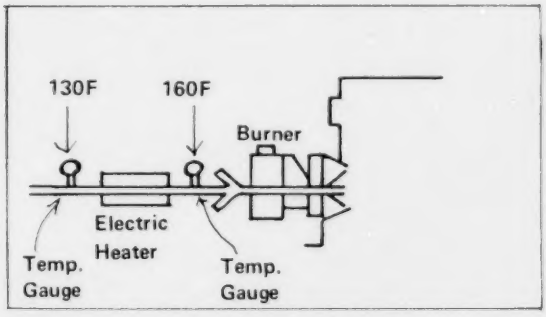
Look at the temperature gauge NEAREST THE BURNER. It should MATCH your ATOMIZING TEMPERATURE.

Suppose that: Atomizing temperature = 160 F.
All oil temperature gauges are working.

CIRCLE THE CORRECT WORD(S) UNDER EACH DIAGRAM.



Oil Temperature IS/IS NOT correct.



Oil Temperature IS/IS NOT correct.

In the first diagram, the oil nearest the burner IS NOT correct. It is 70° below atomizing temperature. This means an oil heating problem. The oil temperature is A–OK in the second diagram.

What is the biggest cause of a smoking boiler? _____

– Check your answer.

Incorrect oil temperature

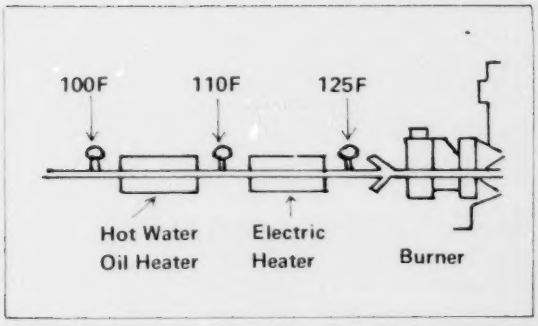
If the oil temperature is wrong, locate the trouble spot by checking the OIL TEMPERATURE AT EACH HEATER. In a line of several heaters, trouble in the first may throw them all off.

What is normal for your heaters is in your Boiler Handbook.

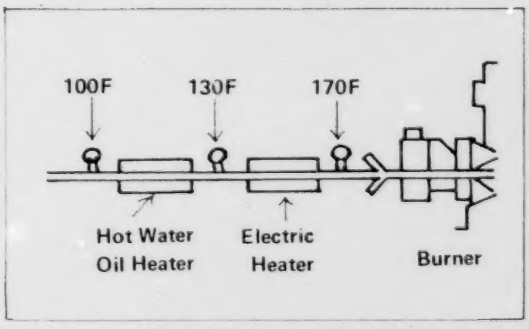
Suppose these temperatures are normal for the heaters below:

Tank Heating Coil Output	– 100 F
Hot Water Oil Heater Output	– 130 F
Electric Heater Output	– 160 F

The Oil Temperature Gauges are working.



1. Which heater is not heating the oil correctly?



2. Which heater is not heating the oil correctly?

– Check your answers.

1. Hot Water Oil Heater (too cold)
2. Electric Oil Heater (too hot)

A SMOKE ALARM!

1. What is the biggest cause of smoke? _____

2. Which oil temperature gauge should you look at first? _____

3. If the oil temperature is wrong, check each individual _____

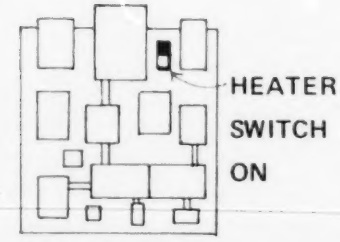
– Check your answers.

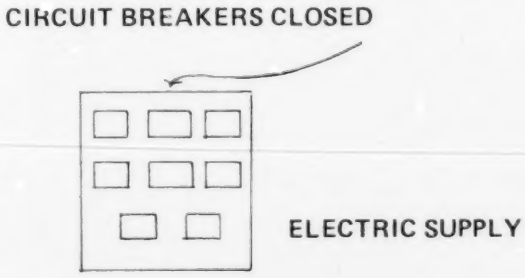
1. incorrect oil temperature
2. one nearest the burner
3. heater

---

2. ELECTRIC HEATER - COLD OIL

If the electric heater isn't heating – check TWO BASICS to be sure it is on!





Know which circuit each breaker monitors.

Your Electric Heater switch may be on your control board or on the Electric Heater. The circuit breaker location varies with each situation.

1. If the circuit breaker is open or switch off, will the electric heater work? _____

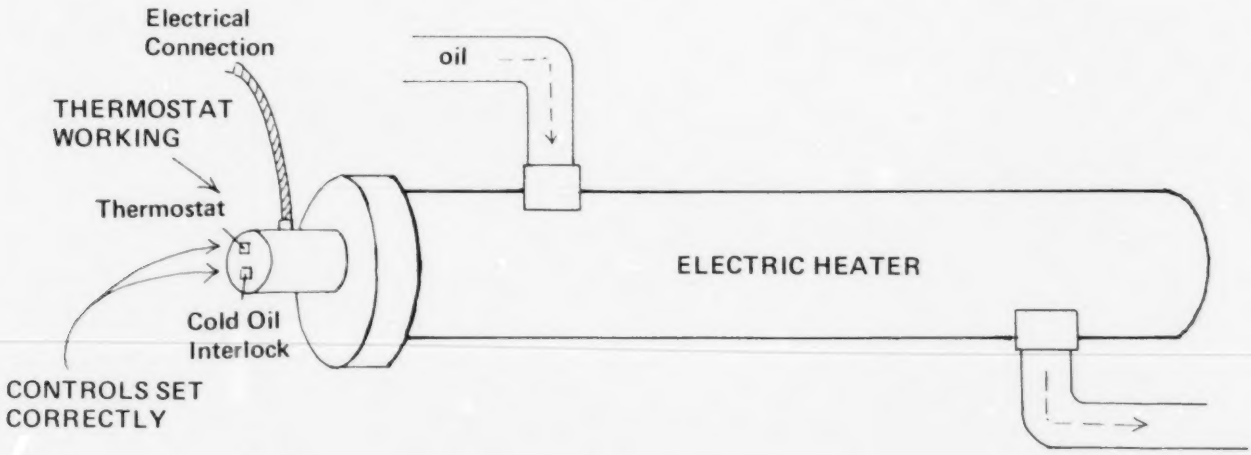
2. Where is your electric heater switch? _____

3. Where are the fuses or cirucit breakers on your system? _____

– Check your answers.

1. No
2. Check your own answer
3. Check you own answer

If the Electric Heater is on – check the TEMPERATURE CONTROL.



The thermostat should be set at the atomzing temperature with the cold oil interlock 15° lower.

The oil should change temperature when the thermostat setting is changed if the thermostat is working.

You or service may replace the thermostat if it is broken.

If the thermostat is working, what should happen when you turn it up? _____

– Check your answer.

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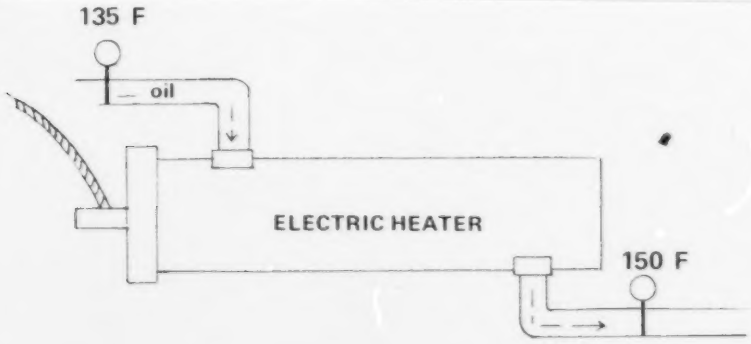
oil gets hotter

CHECK OFF (√) the three troubleshooting steps seen so far: (cold oil in electric heater).

___ HEATER SWITCH ON?
___ CIRCUIT BREAKERS closed?
___ TERMPERATURE CONTROLS set correctly and working?

If you don't find the trouble, check the HEATING ELEMENT before calling service. It will no doubt be replaced by service if broken.



Did the oil temperature go up in this heater? _____

If the temperature goes up (as above), you know the HEATING ELEMENT IS WORKING.

What do you do if you find the heating element not operating? _____

– Check your answer.

call service for replacement

_____

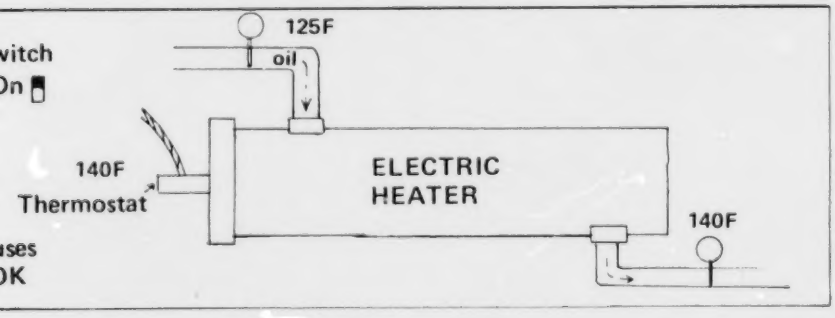
COMPLETE THE TROUBLESHOOTING STEPS for COLD OIL in the ELECTRIC HEATER.

1. Heater _____ on.
2. _____ breakers closed.
3. _____ controls set correctly and working.
4. _____ element working.

These all appear on the previous page. Check your answers and correct them if necessary.

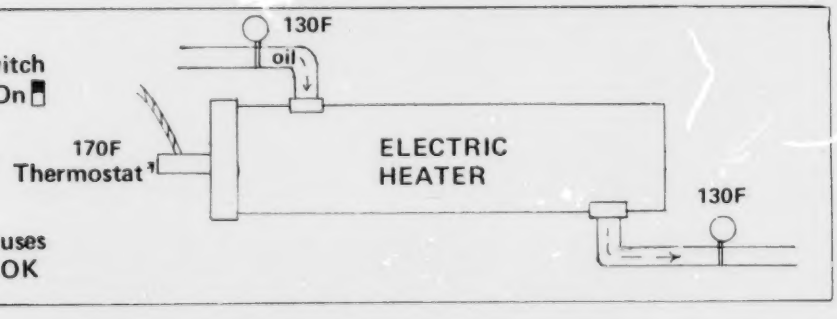
SOME SMOKING BOILERS!

Below are two smoking boilers caused by cold oil coming from the Electric Heater. Beside each write what the probable problem is. Assume the correct atomizing temperature to be 170 F. All oil temperature gauges are working.



1. PROBLEM:

_____



2. PROBLEM:

_____

ANSWERS TO COLD BOILER PROBLEMS:

1. Thermostat needs to be reset.
2. Heating element not working.

ELECTRIC HEATER TROUBLESHOOTING

You have just seen the four checks to make if you get COLD OIL in the ELECTRIC HEATER:

1. Heater switch on
2. Circuit breakers on
3. Thermostat set correctly and working
4. Heating element working

Now – what to do when you get HOT OIL in the ELECTRIC HEATER.

3. ELECTRIC HEATER - OIL TOO HOT

Two things could be causing the Electric Heater to overheat.

1. THERMOSTAT – Is it set correctly? Is it working properly?

2. WARP POINTS (inside the thermostat) – Are they sticking together? If they are, they must be replaced (by you or service).

If these two checks don't solve the problem, call service.

ANSWER THESE QUESTIONS (assume oil temperature gauge OK):

1. What instrument shows that there is a hot oil problem in the Electric Heater? _____

2. When you first find hot oil in the Electric Heater, what control setting should be checked? _____

3. Have your warp points ever been replaced? _____

   If so, who did it? _____

– Check your answers.

1. Oil temperature gauge after the Electric Heater
2. Oil thermostat
3. Check your own answer

When you get hot oil in the Electric Heater, what two things should you check before calling service?

_____

_____

– Check your answers.

1. Thermostat (reset or repair)
2. Warp Points

HANDBOOK SUMMARY

TAKE YOUR BOILER HANDBOOK.

TURN TO PAGE 44.

On Page 44 is a summary of how to Troubleshoot Cold and Hot Oil in the heaters. Use this as reference.

IF YOU HAVE AN ELECTRIC HEATER, TURN TO PAGE 45 IN THE BOILER HANDBOOK.

Write ELECTRIC HEATER at the top of the first column on the table, under "Heaters on this system".

Under Electric Heater, list the COLD OIL CHECKS and HOT OIL CHECKS YOU HAVE JUST LEARNED.

Now – what to do if you find cold oil in the Hot Water Oil Heater.

4. COLD OIL FROM THE HOT WATER OIL HEATER

If you get COLD OIL from the HOT WATER OIL HEATER, check –

1. THERMOSTAT on heater for incorrect setting or breakage.
   To check for breakage, change the thermostat setting, wait, and see if it changes the oil temperature.
2. WATER PUMP and its MOTOR
   If you have them, check out what you can and call service if they are not operating.

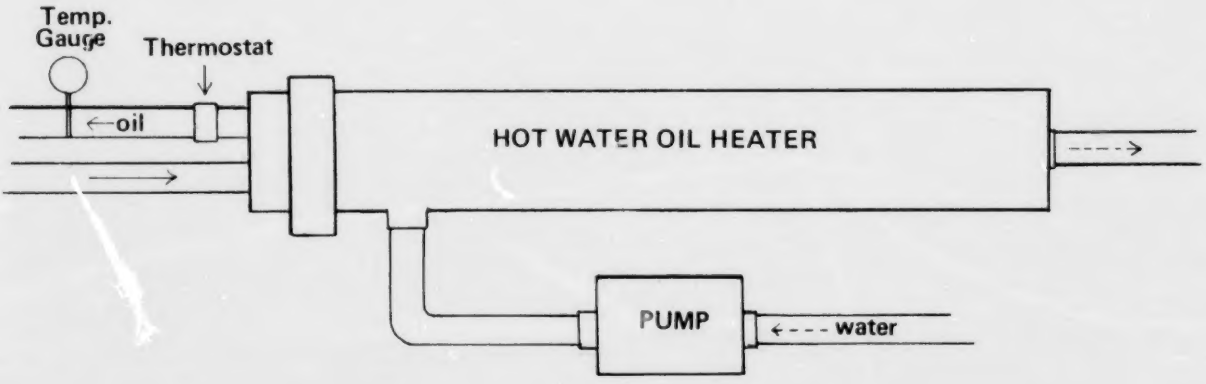
Oil cannot be heated without these two essentials.

1. Which of the above parts determines the temperature of the oil? _____
2. Which of the above delivers hot water to heat the oil? _____

– Check your answers.

1. Thermostat
2. Pump, Motor

On this diagram CIRCLE the parts you would check if you had COLD OIL coming from the HOT WATER OIL HEATER.



If none of these adjustments solve the problem — call service.

— Check your answers.

5. HOT WATER OIL HEATER - OIL TOO HOT

There is only one check to make before calling service if you get hot oil here.

THERMOSTAT Check for correct setting or if it is out-of-order.

1. Does your system use a hot water oil heater? _____

2. What is the normal thermostat setting for your hot water oil heater? _____

— Check your answers.

1. Check your own answer
2. You should have this in your Boiler Handbook.

---

1. If you find HOT OIL in your HOT WATER OIL HEATER, what should you check before calling service?

_____

2. If you find COLD OIL in your HOT WATER OIL HEATER, what should you check before calling service?

_____

_____

— Check your answers.

3

1. Thermostat
2. Thermostat
   Pump, Motor

HANDBOOK SUMMARY

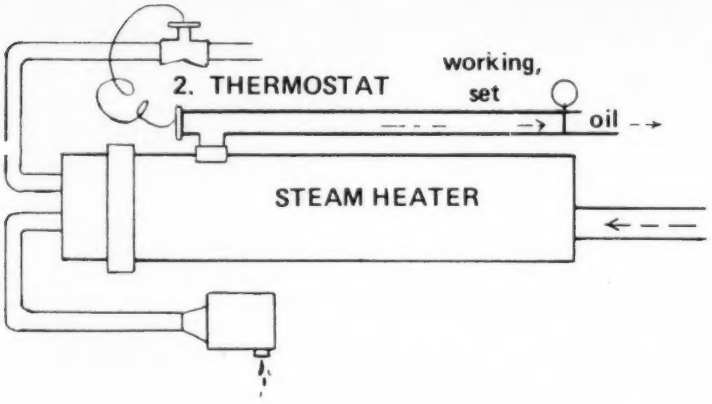
TAKE YOUR BOILER HANDBOOK.
TURN TO PAGE 45.

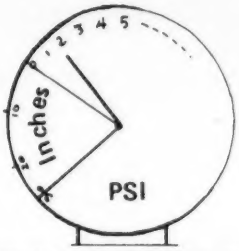
Write HOT WATER OIL HEATER at the top of the second column if you have one. In this column, WRITE THE COLD AND HOT OIL TROUBLESHOOTING CHECKS just covered.

Now – oil temperature problems in the Steam Heater.

6. COLD OIL FROM THE STEAM HEATER

You may have a Steam Oil Heater. CHECK THESE PARTS if you find COLD OIL there.





1. STEAM PRESSURE GAUGE
On boiler
Approx. 2 psi

If the STEAM PRESSURE in the boiler is all right, check the THERMOSTAT for your correct setting.

ANSWER THESE QUESTIONS:

1. What instrument tells you if you have steam in the boiler or not? _____

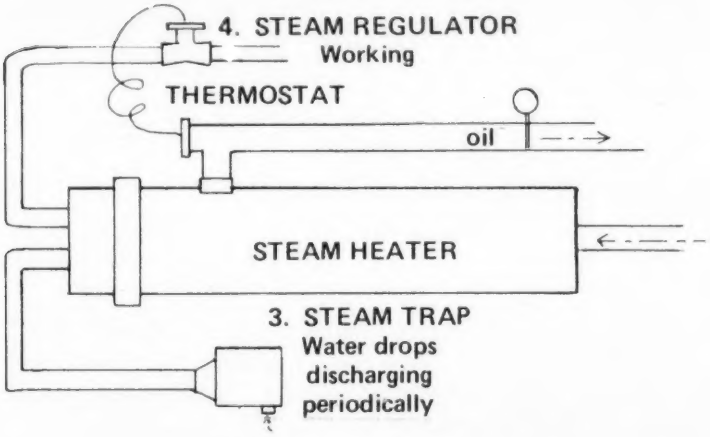
2. What is the approximate boiler steam pressure that you need to heat oil? (see gauge above) _____ _____

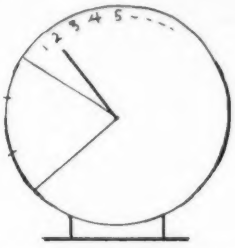
3. If you get cold oil in your Steam Heater, what are the first two things to check? _____

— Check your answers.

1. Steam Gauge
2. 2 p.s.i.
3. Steam Gauge, Thermostat

Here are two more checks to make if you get cold oil.





STEAM PRESSURE GAUGE

The heater discharges condensate (water drops) normally through the STEAM TRAP. If it is discharging steam, something is out-of-order.

The Thermostat is connected to the STEAM REGULATOR and regulates it. Check it for proper operation.

If these steps don't solve cold oil in the STEAM HEATER, call service.

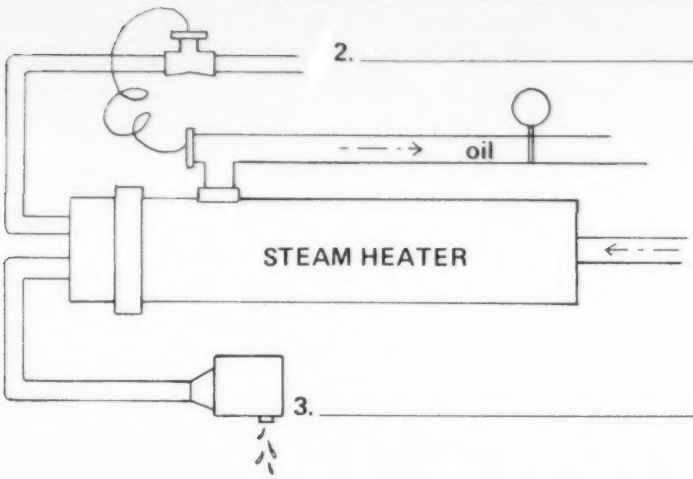
1. How can you tell that the steam trap is working satisfactorily? _____

2. What device does the thermostat control to let the right amount of steam into the heater? _____

– Check your answers.

1. Water drops discharge periodically
2. Steam Regulator

LABEL THE FOUR CHECKS to make on a steam heater delivering cold oil.

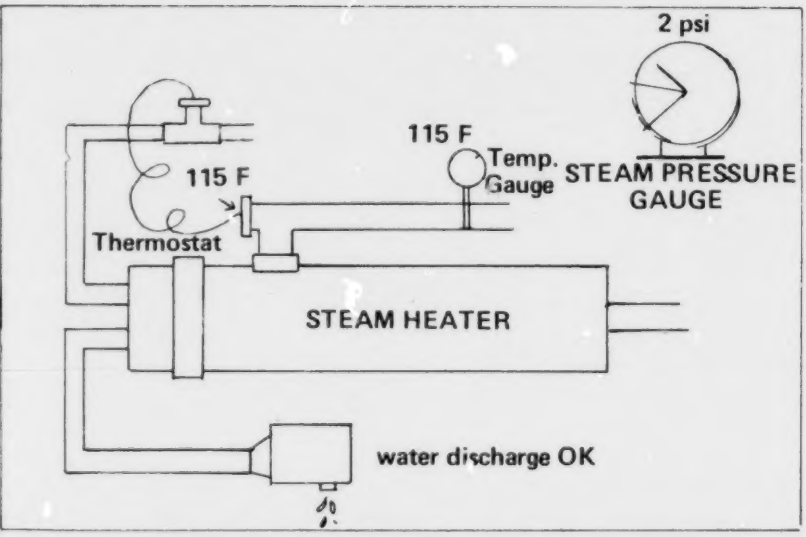


Check your answers.

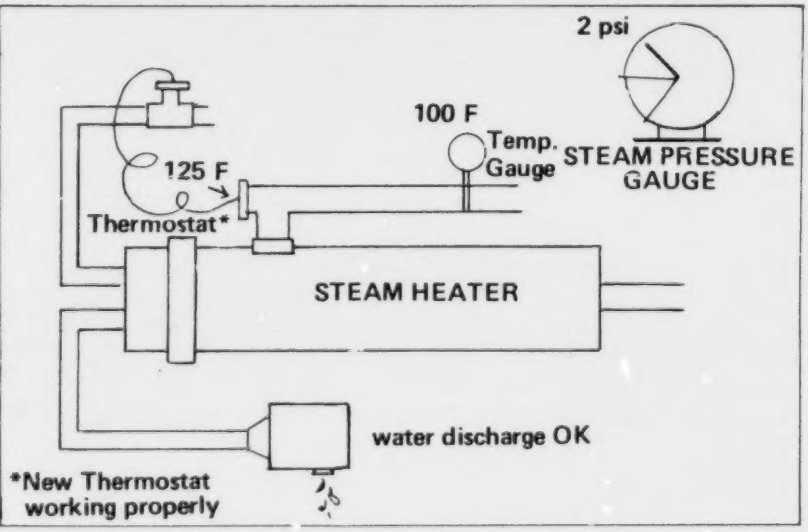
1. Steam pressure in boiler
2. Thermostat
3. Steam Trap
4. Steam Regulator

Below are two Steam Heaters with cold oil problems. WRITE WHAT SEEMS TO BE THE PROBLEM BESIDE EACH.

Suppose that: Normal operating temperature for the steam heater is 125 F and the oil temperature gauge is working.



1. PROBLEM: _____



2. PROBLEM: _____

— Check your answers.

1. Reset thermostat to 125 F
2. Steam Regulator may need repair or replacement

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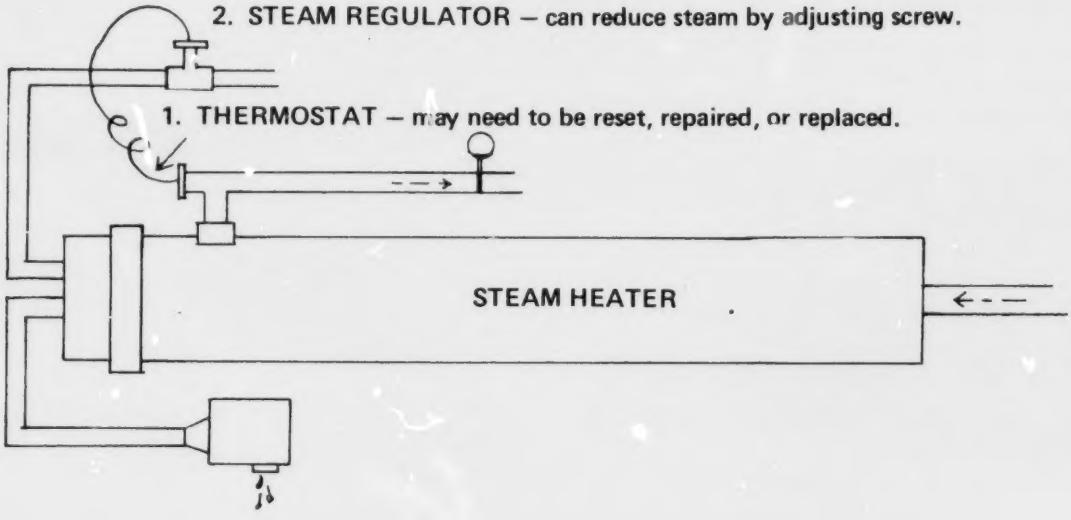
7. STEAM HEATER - OIL TOO HOT

CHECK THESE TWO THINGS to solve a hot oil problem.


2. STEAM REGULATOR – can reduce steam by adjusting screw.
1. THERMOSTAT – may need to be reset, repaired, or replaced.
STEAM HEATER

If these two steps don't solve the problem, call service.

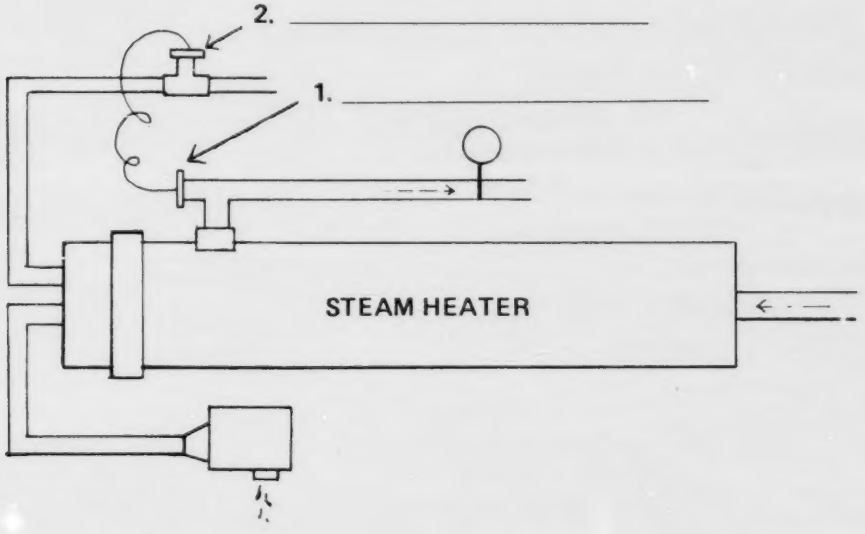
1. What do you always check when you have a temperature problem with a heater? _____

2. Too hot may mean too much steam. Where do you check steam going into the heater? _____

– Check your answers.

1. Thermostat
2. Steam Regulator

There are two checks to make if you get HOT OIL in the STEAM HEATER. LABEL THEM on the diagram below.



Check your diagram with that on the Preceding page.

STEAM HEATER REVIEW

Listed below are the COLD and HOT OIL TROUBLESHOOTING STEPS for the STEAM HEATER – COMPLETE THEM.

COLD OIL – STEAM HEATER

CHECK:

1. _____ _____ Gauge on the boiler.
2. _____ on heater. It should be set correctly and working.
3. _____ _____ to see that only drops of water are discharging periodically.
4. _____ _____ to see that steam is going into the heater properly.

HOT OIL – STEAM HEATER

CHECK:

1. _____ should be set correctly and working.
2. _____ should be admitting steam properly.

– Check your answers.

Answers to Steam Heater Review

COLD OIL:

1. Steam Pressure Gauge on boiler
2. Thermostat on Heater
3. Steam Trap – drops of water periodically
4. Steam Regulator – steam into heater

HOT OIL:

1. Thermostat
2. Steam Regulator

HANDBOOK SUMMARY

TAKE YOUR BOILER HANDBOOK.
TURN TO PAGE 45.

Write STEAM HEATER at the top of the last column on the table if you have one. In this column, WRITE THE COLD AND HOT OIL TROUBLESHOOTING CHECKS just covered.

This completes the basic cold/hot oil checks to make before calling service.

Use BOILER HANDBOOK PAGES 44 – 45 for reference if you get an oil temperature problem.

SUMMARY OF PART III

These questions review the important things in this section:

1. What is the biggest cause of a smoking boiler? _____
2. If you get smoke, what is the first thing to check? _____
3. What gauge right after a heater tells you if there is an oil temperature problem there? _____
4. Is the proper atomizing temperature determined by the oil you use or the burner you have? _____
5. What is one of the first things you always check on any heater when there is an oil temperature problem? _____
6. If you have an open circuit or blown fuse, what will be the temperature problem in the electric heater? _____
7. What heater has to be actually turned on in order to heat the oil? _____
8. What electric heater setting should match the oil atomizing temperature? _____
9. What instruments will tell you if the heating element in the electric heater is working? _____
10. What points inside the electric heater thermostat should be checked if you get hot oil there? _____
11. If the atomizing temperature is 150 F and your electric heater thermostat is set at 160 F, what would you do? _____

12. What should be checked in the case of cold oil in the hot water oil heater to be sure the heater is getting hot water to heat the oil? _____

13. What is the one check you make on the hot water oil heater whether the oil is too hot or too cold? _____

14. What do you need in the boiler in order to get steam in the steam heater? _____

15. What instrument measures how much steam is in the boiler? _____

16. Through what is condensate (drops of water) discharged from the steam heater? _____

17. What instrument is connected to the thermostat and regulates steam going into the steam heater? _____

18. If the oil is too hot in the steam heater, what & two instruments should be checked? _____
19. _____

20. If all troubleshooting checks are made and an incorrect oil temperature problem is not solved, what should be done? _____

– Check your answers.

ANSWERS TO REVIEW QUESTIONS:

1. incorrect oil temperature
2. oil temperature
3. oil temperature gauge
4. oil
5. thermostat
6. cold oil
7. electric heater
8. thermostat
9. oil temperature gauges on each side of heater
10. warp points
11. reset thermostat to 150 F
12. pump
13. thermostat
14. steam pressure
15. steam pressure gauge
16. steam trap
17. steam regulator
18. thermostat
19. steam regulator
20. call service